CLAIMS

What is claimed is:

1. A method for reproduction as part of a computer-implemented optimization

2   process based on a genetic model, comprising the steps of:

(a) generating a set of mating combinations, each mating combination

4   comprising a first chromosome and a second chromosome selected from a set

of chromosomes, each chromosome comprising at least one gene;

6   (b) assigning a composite score to each mating combination; and

(c) selecting a particular mating combination using a biased random

8   value, the biased random value favoring mating combinations having a

favorable composite score, the first and second chromosomes of the particular

10   mating combination comprising first and second parents, respectively.

2. The method of claim 1, wherein assigning a composite score to each mating

2   combination comprises computing the product of a first score associated with the

first chromosome and a second score associated with the second chromosome.

3. The method of claim 1, wherein step (c) comprises:

2   sorting the mating combinations from most favorable to least favorable

according to their associated composite scores, each sorted mating

4   combination having an associated index;

generating a random value distributed uniformly between zero and

6   one;

8 　　　raising the random value to a predetermined power greater than one to
　　　produce the biased random value;

10 　　　multiplying the number of mating combinations by the biased random
　　　value to compute a selection index; and

12 　　　selecting as the particular mating combination the mating combination
　　　whose index corresponds to the selection index.

4. The method of claim 1, further comprising:

2 　　　preventing the particular mating combination from being selected more

　　　than once.

5. The method of claim 1, further comprising:

2 　　　duplicating one of the first parent and the second parent to produce a

　　　child chromosome; and

4 　　　mutating a gene in the child chromosome.

6. The method of claim 5, wherein the gene to be mutated is selected randomly and

2 　　mutating the gene in the child chromosome comprises randomly modifying the

　　　gene in the child chromosome

7. The method of claim 1, further comprising:

2 　　　mating the first parent with the second parent to produce a child

　　　chromosome for a first predetermined fraction of children produced; and

4 　　　mutating a copy of the first parent to produce a child chromosome for a

　　　second predetermined fraction of children produced.

8. The method of claim 1, wherein each gene represents a characteristic of an

2   instance in an integrated circuit, the characteristic comprising one of size and

threshold voltage.

9. A method for reproduction as part of a computer-implemented optimization

2   process based on a genetic model, comprising the steps of:

generating a set of mating combinations, each mating combination

4   comprising a first chromosome and a second chromosome selected from a set

of chromosomes, each chromosome comprising at least one gene;

6   assigning a composite score to each mating combination;

sorting the mating combinations from most favorable to least favorable

8   according to their associated composite scores, each sorted mating

combination having an associated index;

10   generating a random value distributed uniformly between zero and

one;

12   raising the random value to a predetermined power greater than one to

produce a biased random value;

14   multiplying the number of mating combinations by the biased random

value to compute a selection index; and

16   selecting the first and second chromosomes of the mating combination

whose index corresponds to the selection index as first and second parents,

18   respectively.

10. The method of claim 9, further comprising:

2   preventing the mating combination whose index corresponds to the

selection index from being selected more than once.

11. The method of claim 9, further comprising:

2   duplicating one of the first parent and the second parent to produce a

child chromosome; and

4   mutating a gene in the child chromosome.

12. The method of claim 11, wherein the gene to be mutated is selected randomly and

2   mutating the gene in the child chromosome comprises randomly modifying the

gene in the child chromosome.

13. The method of claim 9, further comprising:

2   mating the first parent with the second parent to produce a child

chromosome for a first predetermined fraction of children produced; and

4   mutating a copy of the first parent to produce a child chromosome for a

second predetermined fraction of children produced.

14. The method of claim 9, wherein each gene represents a characteristic of an

2   instance in an integrated circuit, the characteristic comprising one of size and

threshold voltage.

15. A method for reproduction as part of a computer-implemented process based on a

2   genetic model for optimizing the power consumption and timing of an integrated

circuit comprising a plurality of instances, the method comprising:

4   providing a set of chromosomes, each chromosome comprising a

plurality of genes representing a set of design choices for the instances in the

6   integrated circuit, each instance being mapped to a first gene representing the

size of that instance and a second gene representing the threshold voltage of

8   that instance;

simulating for each chromosome the power consumption and timing

10   performance of an integrated circuit corresponding to the set of design choices

specified by the genes in that chromosome;

12   assigning a score to each chromosome according to its simulated

power consumption and timing performance;

14   generating a set of mating combinations, each mating combination

comprising a first chromosome and a second chromosome selected from the

16   set of chromosomes;

assigning a composite score to each mating combination, the

18   composite score comprising the product of the score associated with the first

chromosome and the score associated with the second chromosome;

20   sorting the mating combinations from most favorable to least favorable

according to their associated composite scores, each sorted mating

22   combination having an associated index;

generating a random value distributed uniformly between zero and

24   one;

raising the random value to a predetermined power greater than one to

26 produce a biased random value;

multiplying the number of mating combinations by the biased random

28 value to compute a selection index; and

selecting the first and second chromosomes of the mating combination

30 whose index corresponds to the selection index as first and second parents,

respectively.

16. The method of claim 15, further comprising:

2 preventing the mating combination whose index corresponds to the

selection index from being selected more than once.

17. The method of claim 15, further comprising:

2 duplicating one of the first parent and the second parent to produce a

child chromosome; and

4 mutating a gene in the child chromosome.

18. The method of claim 17, wherein the gene to be mutated is selected randomly and

2 mutating the gene in the child chromosome comprises randomly modifying the

gene in the child chromosome.

19. The method of claim 15, further comprising:

2 mating the first parent with the second parent to produce a child

chromosome for a first predetermined fraction of children produced; and

4   mutating a copy of the first parent to produce a child chromosome for a

second predetermined fraction of children produced.

20. A system programmed to perform the following method:

2   (a) providing a set of chromosomes, each chromosome comprising at

least one gene;

4   (b) generating a set of mating combinations, each mating combination

comprising a first chromosome and a second chromosome selected from the

6   set of chromosomes;

      (c) assigning a composite score to each mating combination; and

8   (d) selecting a particular mating combination using a biased random

value, the biased random value favoring mating combinations having a

10   favorable composite score, the first and second chromosomes of the particular

mating combination comprising first and second parents, respectively.

21. The system of claim 20, wherein step (d) of the method comprises:

2   sorting the mating combinations from most favorable to least favorable

according to their associated composite scores, each sorted mating

4   combination having an associated index;

      generating a random value distributed uniformly between zero and

6   one;

      raising the random value to a predetermined power greater than one to

8   produce a biased random value;

      multiplying the number of mating combinations by the biased random

10   value to compute a selection index; and

selecting as the particular mating combination the mating combination

12 whose index corresponds to the selection index.

22. The system of claim 20, wherein the method comprises the following additional

2 steps:

duplicating one of the first parent and the second parent to produce a

4 child chromosome; and

mutating a gene in the child chromosome.

23. The system of claim 20, wherein the method comprises the following additional

2 steps:

mating the first parent with the second parent to produce a child

4 chromosome for a first predetermined fraction of children produced; and

mutating a copy of the first parent to produce a child chromosome for a

6 second predetermined fraction of children produced.

24. A system for performing reproduction as part of a computer-implemented

2 optimization process based on a genetic model, comprising:

means for providing a set of chromosomes, each chromosome

4 comprising at least one gene;

means for generating a set of mating combinations, each mating

6 combination comprising a first chromosome and a second chromosome

selected from the set of chromosomes;

8 means for assigning a composite score to each mating combination;

and

10   means for selecting randomly a particular mating combination such

that mating combinations having a favorable composite score are favored, the

12   first and second chromosomes of the particular mating combination

comprising first and second parents, respectively.

25. The system of claim 24, wherein the means for selecting randomly a particular

2   mating combination such that mating combinations having a favorable composite

score are favored further comprises:

4   means for sorting the mating combinations from most favorable to

least favorable according to their associated composite scores, each sorted

6   mating combination having an associated index;

means for generating a random value distributed uniformly between

8   zero and one;

means for raising the random value to a predetermined power greater

10   than one to produce a biased random value;

means for multiplying the number of mating combinations by the

12   biased random value to compute a selection index; and

means for selecting as the particular mating combination the mating

14   combination whose index corresponds to the selection index.

26. The system of claim 24, further comprising:

2   means for duplicating one of the first parent and the second parent to

produce a child chromosome; and

4   means for mutating a gene in the child chromosome.

27. The system of claim 24, further comprising:

2   means for mating the first parent with the second parent to produce a

child chromosome for a first predetermined fraction of children produced; and

4   means for mutating a copy of the first parent to produce a child

chromosome for a second predetermined fraction of children produced.

28. A computer-readable storage medium containing program code to perform

2   reproduction as part of an optimization process based on a genetic model, the

computer-readable storage medium comprising:

4   a first code segment configured to generate a set of mating

combinations, each mating combination comprising a first chromosome and a

6   second chromosome selected from a set of chromosomes, each chromosome

comprising at least one gene;

8   a second code segment configured to assign a composite score to each

mating combination; and

10   a third code segment configured to select a particular mating

combination using a biased random value, the biased random value favoring

12   mating combinations having a favorable composite score, the first and second

chromosomes of the particular mating combination comprising first and

14   second parents, respectively.

29. The computer-readable storage medium of claim 28, wherein the third code

2   segment comprises instructions causing the computer to

sort the mating combinations from most favorable to least favorable

4 according to their associated composite scores, each sorted mating

combination having an associated index;

6 generate a random value distributed uniformly between zero and one;

raise the random value to a predetermined power greater than one to

8 produce a biased random value;

multiply the number of mating combinations by the biased random

10 value to compute a selection index; and

select as the particular mating combination the mating combination

12 whose index corresponds to the selection index.

30. The computer-readable storage medium of claim 28, further comprising:

2 a fourth code segment configured to duplicate the first parent to

produce a child chromosome; and

4 a fifth code segment configured to mutate a gene in the child

chromosome.

31. The computer-readable storage medium of claim 28, further comprising:

2 a fourth code segment configured to mate the first parent with the

second parent to produce a child chromosome for a first predetermined

4 fraction of children produced; and

a fifth code segment configured to mutate a copy of the first parent to

6 produce a child chromosome for a second predetermined fraction of children

produced.